METHOD AND PRODUCTS TO ABSORB OIL AND ORGANIC SOLVENTS FROM WATER AND FROM SEA

The release of organic solvents and ~~of~~ oil into the environment and in water basins leads to disasters. ~~And the~~ consequences of these accidents are the destruction of the environment and the disruption of the chains of life.

A most critical such environmental problem is created by the release of oil during the sea transportation because of sea accidents. Another ~~such~~ critical problem directly connected with life is the pollution in sea ports and in enclosed seas around main cities.

Such pollution loads are also formed in navigable rivers and in lakes by ~~rejection~~ of petroleum and oil, and also during pumping of petroleum ~~in~~ rivers, ~~in~~ lakes and in sea from ~~the~~ existing ~~there~~ production wells ~~where~~ heavy pollution problems ~~are created~~.

The ~~facing~~ of those environmental problems is, up to date, unsuccessful, insufficient or incorrect. ~~detergents~~ are used with which the suspended petroleum and oils are emulsified to become bottom sludge deposits. ~~To the~~ sea ~~basin are thus summed huge pollution loads in between and in Mediterranean sea with intense petroleum~~ transportation transportation traffic, the pollution loading has become 0.3-0.8 g/liter and the bottom sludge formed exceeds the 2.000 tons/ km^3 which makes a World maximum.

We have dealt in long lasting R & D work with ~~that~~ this problem and have developed a solution by which ~~those~~ these water and sea pollution accidents are successfully ~~faced~~ remediated because our solution works with absorption of the petroleum and of oils from sea and water surfaces and thus leads to their useful recycling.

We have discovered, constructed and proved in practice polymers multiprocessed to become ~~macroplegmatic~~ macroreticular, and we have proved that these operate with effective absorption ~~of~~ petroleum , ~~of~~ oil and ~~of~~ organic solvents in a quantity 30 to 60 times their weight intermolecularly. With external sorption adherence, more quantities are absorbed so that ~~totally are collected~~ high quantities of released petroleum and oils are finally collected into the water basins. The operation of the ~~action~~ treatment is ~~organised~~ organized with loading ~~those~~ these absorption products into a net which is suspended in the water surface and operates like a broom quantitatively absorbing ~~quantitatively~~ and sweeping all the oily pollution loads which are transported in tanks, where ~~those~~ they are washed with petroleum and are collected as useful fuel.

~~The AC~~ absorbing products ~~are used~~ polymeric products ~~resulted from Polystyrene and copolymers new or recycled~~ derived in a wide range of ~~composition so that can~~ compositions cover a wide variety of uses. These polymers are processed to become ~~macroplegmatic on~~ macroreticular structure designed to absorb organic solvents and oil molecularly in pure form or in mixtures according to existing conditions.

The polymers bases in use are the following:

Polystyrene which after special processing becomes ~~macroplegmatic with Mc 50.000.~~

The trimeric copolymer SEBS (Styrene, Ethylene, Butadiene, Styrene) which is specially crosslinked to become ~~macroplegmatic~~ macroreticular.

~~The elastomeric SBR fully~~ hydrogenated ~~with Styrene~~ composition 10%, 20% and 40% which after special cross-linking and processing gave ~~macroplegmatic~~ macroreticular products ~~of variation in absorbing capacities.~~

The cross-linking is advanced in solutions containing ~~those~~ polymers ~~20-25%~~ 20-25% by weight of in chlorinated hydrocarbon solvents ~~by weight~~ such as dichloroethane with cross-linking agent ~~the 1,4-dichloromethyl-2,5-dimethylobenzene (DCMDMB) and~~ for catalytic action, ~~is used~~ is used tectrachlorotitane (TiCl4) in 10% solution in dichloroethane.

The appearance of thickness that is the cross-linking ~~result is related to the catalytic action which is added, however, in small quantities in drops and is effective in~~ high solution volumes.

In the following Tables are given the results of the weight ratio of cross-linking agent to the SEBS polymer ~~SEBS in weight ratio~~ in reaction at 60°C. To determine the absorption capacity, the porosity is studied, which was found to be low up to 4% of cross-linking agent and then increase ~~to increase~~.

TABLE 1.

DMDMB ,%	SEBS, resulted porosity (cm3/g)
1	0.294
2	0.204
4	0.279
16	0.319
32	0.477

The absorption capacity of organic solvents selected from market products, derived from petroleum, was then studied

Table 2.

Absorption of Toluene in water- PS

C initial PPM	C final PPM
413,9	0.68
102,1	0.59
363,3	0.78

Absorption of Toluene Water-SEBS

410,4	0.4
319.6	0.39
119.9	0.37

Absorption of 1,2-Dichloroethane - Water , SEBS

692,2	0.4
202,7	0.56

Absorption of Decane-water, SEBS

456,2	0.35
623,4	0.37

Absorption of Petrol-water ,SEBS

653,4	0.36
638,2	0.34

Table 3.

Absorption capacity of the different absorption products per gram.

	1	2	3	4
PS	-	-	-	-
SEBS	4,5	7,5	9.0	5,0
SBR (10)	50,0	45.0	40.0	30.0
SBR (20)	48.0	40.0	38.0	25.0

	5	6	7	8
PS	-	-	-	12
SEBS	8	9.0	6.0	17
SBR(10)	32.0	29.0	33.0	36
SBR(20)	27.0	26.0	31.0	31.0

	9	10	11	12	13
PS	17	28	25	18	18
SEBS	18	18	12	22	22
SBR(10)	37	-	-	16	15
SBR(20)	32	-	-	12	13

1 n-pentane, 2 n-hexane , 3 n-octane , 4 isooctane, 5 n-nonane, 6 n-decane 7 n-dodecane , 8 benzene, 9 toluene, 10 chloroform, 11 carbon tetrachloride, 12 1,2 dichloroethane, 13 1,1,3 trichloroethane .

~~With the~~ The above results ~~which~~ are successful and very useful. ~~we have~~ We also studied the absorption capacity on oil surface pollution in ~~harbours~~ harbors and the absorption capacity in sea. For these trials, the absorption polymers were placed in a polypropylene net in composition 20% PS, 30% SEBS, 30% SBR (10) and 20% SBR (20), and the results obtained were very impressive. ~~And it~~ It was proved that the sweeping was not due to endomolecular absorption but also due to external absorption adherence so that the collection of oily matter was very satisfactory. ~~That~~ The load of ~~oil~~ oily matter is ~~brought~~ collected in a tank and is washed with petroleum by which all those oils are collected as useful fuels. That is this seeping action makes the pollution loads useful and the harbours and the sea as well as the sea bottom are liberated from oily and dirty matter, and the ecology is overall improved.

EXAMPLE 1

In a reactor of 0.5 m^3 capacity is brought (a) ~~dichloroethane 200 liter and is added (b) the polymer~~ SEBS, ~~30 kg.~~ and in the solution is added (c) 1,4-dichromethyl -2,5-dichlorobenzene ~~100 grms~~ and at 60°C is added (d) the catalyst TiCl4 as 10% solution. After agitation for 40 minutes the cross-linking started and the solution becomes viscous and thick and cannot be agitated further. ~~Then~~ The product is taken off and is cut in a mincing machine and then is brought to a reactor for taking the solvent out to become commercial product. ~~That~~ The reactor is heated up to 170°C under vacuum and stirring so that all the solvent is taken off and the polymeric product is completely ~~deodorised~~ deodorised.

~~Under the same conditions is treated the Polystyrene and~~ the SBR 10%, 20% and 40% in Styrene fully hydrogenated to saturation with the addition of ~~the~~ 2% crosslinking agent ~~in 2%~~ in all, calculated on the benzene rings present.

EXAMPLE 2

Products of example 1 in composition quantities Polystryrene 30% , cross-linked SEBS 30% , cross-linked SBR 10% in Styrene ,fully hydrogenated to saturation 20% and SBR 20% in Styrene fully hydrogenated to saturation 20%, are brought ~~on~~ in a polypropylene net and are swept along on harbour surface. By sweeping the surface all oily matter is collected in quantity 20% endomolecularly and in quantity 80% adhered externally. The net with the

polymers ~~loaded~~ loaded is brought to a tank and washed with petroleum and the oily matter is recycled as fuel and the absorption polymers are ready to be ~~reutilised~~ re-utilized.

EXAMPLE 3

Products of example 1 in composition quantities 10% crosslinked Polystyrene , 30% crosslinked SEBS , 40% crosslinked SBR ,10% in Styrene fully hydrogenated to saturation, are brought to sweep ~~of~~ sea surface pollution. The oil surface swept was that apart ~~of~~ from the main oxidised petroleum mass, which is collected otherwise. The materials of the net ~~swept~~ were drawn by about to sweep successfully the sea surface ~~being drawn by a boat~~. All the oily water was collected and the sea net was brought to a tank, ~~washing~~ washing the net with petroleum ~~to receive~~ reclaimed the absorbed oily matter which was recycled as fuel, and the sea and the sea bottom pollution is avoided.

EXAMPLE 4

In a lake where there is released petroleum and organic solvents from transportation and from production wells, ~~was brought~~ the net of example 3 ~~and~~ is swept on the surface while being drawn by a boat. The oily matter swept was by 25% endomolecularly absorbed and by 75% externally absorbed-adhered. It was ~~brought~~ collected in a tank and washed with petroleum to collect the oily matter absorbed as fuel and the net with the absorbing polymers was recycled ~~to use~~ for reuse.

EXAMPLE 5

The polymer net of example 4 is placed at the flow of a river, the water of which contains oily matter. The action on the river was to collect all suspended oily matter, and the water flow is established with natural pure water flow.